2010 North Idaho Douglas-fir Tussock Moth Pheromone Trapping Report

Report No. IDL 10-2
December 2010

2010 NORTH IDAHO DOUGLAS-FIR TUSSOCK MOTH TRAPPING SYSTEM REPORT

Tom Eckberg, Lands Program Specialist-Forest Health,

Neal Kittelson, Forest Health Data Coordinator,

Idaho Department of Lands

Lee Pederson, Entomologist,

Doug Wulff, Biological Science Technician,

USDA Forest Service, Northern Region, Coeur d'Alene

Report No. IDL 10-2
December 2010

Introduction

Idaho's Douglas-fir tussock moth (DFTM) Early Warning System (EWS) uses a series of permanent pheromone trap sites to identify increasing populations prior to undesirable tree defoliation, a system modified after Daterman et al. (1979). This pheromone trapping is designed to detect population changes over large geographic areas, and to give land managers advance warning of an impending outbreak.

The Idaho Department of Lands (IDL) maintains a network of trap sites from Coeur d'Alene south to Moscow and east to Harvard (Figure 1), with additional trap sites maintained by the United States Forest Service. Personnel from Forest Health Protection, Coeur d'Alene Field Office, (USFS-R1) maintain trap sites from Potlatch to Lucille (Figure 2), while Forest Health Protection personnel from the Boise Field Office, (USFS-R4) monitor trap sites in southern Idaho.

To monitor the flight of male moths, five pheromone-baited sticky traps are installed at each site in a transect with a minimum spacing of 75 feet between traps. Traps are placed in young, open-grown host trees (grand fir or Douglas-fir) in late July to early August and collected in October. An average trap catch of 25 moths per trap is the threshold used to indicate where defoliation may occur in following years. Follow up sampling is then conducted in these areas to pinpoint injurious population densities (Daterman et al. 1979) and to apply treatments, if necessary. Egg mass sampling is conducted in the fall, and larval sampling is conducted in the spring of the following year at sites where trap counts reach the threshold. Larval sampling may also be conducted at sites with historic tussock moth problems before trap counts reach an average of 25 per trap.

2010 Trapping Results

A total of 166 sites were monitored in northern Idaho (134 by IDL and 32 by USFS-R1), while 7 sites were monitored in southern Idaho (USFS-R4) during 2010. The mean trap capture for the IDL traps in 2010 was 11.77 moths per trap, compared to 11.86 and 1.12 moths per trap in 2009 and 2008 respectively (Figure 3). The average trap capture for the USFS R1 traps was 1.08 moths per trap, compared to 2.06 and 0.30 moths per trap in 2009 and 2008 respectively. USFS-R4 personnel placed traps at the same sites used in 2008 and 2009, and this year the average number was 0.16 moths per trap.

Twenty-one trap sites in north Idaho had average trap captures ≥ 25 per trap, and two sites exceeded 50 moths per trap in 2010. This is a slight decline from 2009, when 22 trap sites averaged ≥25 moths per trap and 4 trap sites averaged ≥ 50 moths per trap. The site with the highest average was trap site 301 in McCroskey State Park, with an average trap catch of 62.8 moths per trap (Appendix 1). When the trap averages are separated by the areas of past outbreaks (Moscow Mountain, McCroskey State Park, and Coeur d'Alene Indian Reservation), only the trap sites in McCroskey State Park increased, from an average of 16.8 in 2009 to 19.7 in 2010.

The overall averages of sites monitored by USFS Regions 1 and 4 declined in 2010. Only one of the trap sites monitored by USFS-R1 exceeded 5 moths per trap, while all sites monitored by USFS-R4 averaged 0.2 moths per trap or less (Appendix 2, Appendix 3).

Defoliation

Prior to 2010, the most recent outbreak in north Idaho occurred in 2000, and resulted in three years of defoliation on state and private land between Plummer and Moscow, and in adjacent Clearwater National Forest lands (Figure 4). Outbreaks of DFTM have occurred in this general area approximately every 8-10 years since the 1940's. Prior to the 2000 outbreak, aerially visible defoliation occurred for one year during 1986. Both outbreaks were preceded by increasing numbers of trap captures (Randall 2002) (Figure 3). In 2010, defoliation was visible from the air in both Kootenai and Benewah Counties. The largest defoliated area was south of Post Falls near Mica Peak and Signal Point (approximately 6000 acres), and also in adjacent Washington state (Figure 5). Additional defoliation occurred in the Plummer area (approximately 2000 acres) in an area where defoliation would be expected. Additional defoliation of forested stands totaling approximately 600 acres of second growth Douglas-fir occurred northeast of Twin Lakes. In contrast to previous outbreaks, the 2010 defoliation was not preceded by steadily increasing trap captures (Figure 3). There has not been significant defoliation in forested areas of Kootenai County since the outbreak of 1974, when 1800 acres were defoliated on the Coeur d'Alene National Forest east of Lake Coeur d'Alene (Tunnock et al. 1985). Defoliation was not observed near Moscow Mountain or McCroskey State Park, where in the past most defoliation had occurred. Ornamental spruce and grand fir trees have been damaged by DFTM in the Coeur d'Alene area since at least 2007. Damage to ornamentals is common before outbreaks develop in the forest (Sturdevant 2000, Tunnock 1985). The populations of DFTM infesting the ornamental blue spruce at the USFS nursery in Coeur d'Alene appear to have collapsed after 3 years of defoliation.

Larval Surveys

IDL normally conducts larval sampling in north Idaho using a threshold less than 25 moths per trap. Trap sites where trap catches have increased, or historical trouble spots are likely sites for larval surveys in the following year. Larval surveys were performed at 65 of the 134 plots trapped by IDL in 2010 (Appendix 1), using the lower crown sequential sampling methods described by Mason

(1978). Larvae were observed at 47 of these sites, and of these, 27 were classified as having suboutbreak populations (Figure 6). Eight were classified as having intermediate populations, and the remaining locations had low populations of DFTM. By comparison, in 2009, a total of 44 sites were sampled (lower crown), and larvae were observed at 27 sites. Five sites had suboutbreak populations, one was intermediate, and the remainder had low populations. Mid-crown sampling for later instars was performed at 19 sites that had high larval populations in 2010.

Egg Mass Sampling

Egg mass sampling was conducted at 104 sites in 2010. Sampling was concentrated near trap sites that had high trap numbers in 2010, or where defoliation was observed this year. Sampling near defoliated areas was an attempt to delimit areas of high DFTM populations. Egg masses were found at 63 of the 104 sites (Figure 7). If the trap average exceeded 20, sampling was conducted by examining grand fir and Douglas-fir trees for ten minutes, and counting the number of egg masses observed. If no egg masses were found, twenty additional trees were examined for egg masses and cocoons. Additional egg mass samples were taken approximately one mile away (using the cardinal directions) if the trap average exceeded 25. The defoliated areas in Kootenai County were in areas without a previous history of serious defoliation, therefore there were limited numbers of adult traps nearby. To better determine the extent of high DFTM populations, egg mass samples were intensified in these areas, especially along Signal Point Road, south of Post Falls. Large numbers of egg masses were found on Signal Point Road at most sampling sites. Egg mass sampling in the Moscow Mountain and McCroskey State Park areas revealed building populations, but the number of sampling sites without egg masses was higher. Less than half of the sites sampled in these areas had egg masses.

Conclusions

The DFTM-EWS has been generally effective at predicting outbreaks in northern Idaho. The two previous outbreaks were preceded by several years of increasing trap catches. However, the intensity of the outbreaks was not predicted by trapping alone. Trap catches preceding defoliation in 1986 were similar to trap captures prior to the 2000 outbreak; yet the intensity of the two outbreaks was very different. The outbreak in 1986 caused detectable defoliation for one year, while defoliation in the 2000 outbreak was evident for three years. The current outbreak is different for several reasons; the overall average trap catch did not increase from 2009 to 2010, and defoliation was observed in unexpected areas. The average trap count actually declined slightly in 2010 (11.77) compared to 2009 (11.86). This confirms the need for additional population sampling, such as egg mass and larval sampling to help determine the intensity of outbreaks (Mason and Torgersen 1983, Kegley et al. 2004).

Lower crown sampling was completed at 65 sites in 2010, with approximately 40% of these having suboutbreak populations. Mid-crown samples were taken at 19 of the same sites in July to gauge larval survival. Only one site had high populations of larvae (Lovell Valley #912), and this was the only site sampled that experienced defoliation later in the season. The egg mass surveys conducted in the fall of 2010 indicate that there will likely be additional defoliation in areas that are currently experiencing defoliation (Plummer and Signal Point). Egg mass surveys near Moscow Mountain and McCroskey State Park (where defoliation historically occurred) indicate that DFTM populations are building, and defoliation in these areas may occur in 2011. Egg mass and larval surveys provide estimates of population densities and give more accurate indications of outbreak potential and population trends. Pheromone trapping is designed to detect population changes over large geographic areas.

The DFTM EWS **is not designed nor intended** to predict the exact location of future defoliation. Follow-up sampling is conducted in areas that are selected based on historical experience and the

potential impact of DFTM defoliation on management objectives. Because the lures used in Douglas-fir tussock moth EWS traps contain low concentrations of pheromones, they are **not** calibrated for use during an actual DFTM outbreak. As populations reach outbreak levels, a decline in trap catches will typically be observed. The large numbers of female moths present during an outbreak produce enough pheromone to mask the attractiveness of the lures (Sheehan and Ragenovich 2003). The defoliation observed in 2010 was not preceded by increasingly higher average trap captures as in the two previous outbreaks. There was a slight decrease in trap captures from 2009 to 2010, but this was likely not due to masking by female pheromones. Trap capture results indicate that the outbreak is still building, and the reasons for the decline are not clear. Trap captures in the historical problem areas are expected to increase in 2011. Trap averages in the eastern edge of the sampling area (Santa-Fernwood area) were low and decreased the overall average. Some of these trap sites may be dropped in 2011 in order to increase sampling efforts in the north.

The unusual nature of the current outbreak illustrates the importance of an integrated sampling plan utilizing pheromone traps, supplemental sampling (larval and egg mass), as well as aerial detection. Characterizing the full extent of the defoliation would have been difficult without an aerial survey, because defoliation occurred in areas that had not experienced outbreaks in the recent past.

Literature Cited

Daterman, G.E., R.L. Livingston, J.M. Wenz, and L.L. Sower. 1979. Douglas-fir tussock moth handbook. How to use pheromone traps to determine outbreak potential. USDA Agriculture Handbook No. 546. 11 p.

Kegley, S.J., D. Beckman, and D.S. Wulff. 2004. 2003 North Idaho Douglas-fir tussock moth trapping system report. USDA Forest Service, Northern Region, Forest Health Protection Rpt. 04-6. 7pp. (Link)

Mason, R.R. 1978. Detecting suboutbreak populations of the Douglas-fir tussock moth by sequential sampling of early larvae in the lower tree crown. Research Paper PNW-238. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 9pp.

Mason, R.R. and T.R. Torgersen. 1983. Douglas-fir tussock moth handbook. How to predict population trends. USDA Agriculture Handbook No. 610. 7 p.

Randall, C. 2002. Douglas-fir tussock moth biological evaluation, Palouse Ranger District, Clearwater National Forest, 2001. USDA Forest Service, Northern Region, Forest Health Protection Rpt. 02-5. 33pp. (Link)

Sheehan, K.A. and I. Ragenovich. 2003. 2002 Douglas-fir tussock moth early warning system trapping summary for Oregon and Washington. USDA Forest Service, Pacific Northwest Region, Forest Health Protection & Air Management Group/Natural Resources. 8p. (Link)

Sturdevant, N. 2000. Douglas-fir tussock moth in northern Idaho and western Montana, current activity and historical patterns. USDA Forest Service, Northern Region, Forest Health Protection Rpt. 00-12. 6 p. (Link)

Tunnock, S., M. Ollieu, and R. W. Their, 1985. History of Douglas-fir tussock moth and related suppression efforts in the Intermountain and Northern Rocky Mountain Regions 1927 through 1984. USDA Forest Service Intermountain and Northern Regions. Rpt. 85-13. 51 pp. (Link-*Very large file*)

Figures:

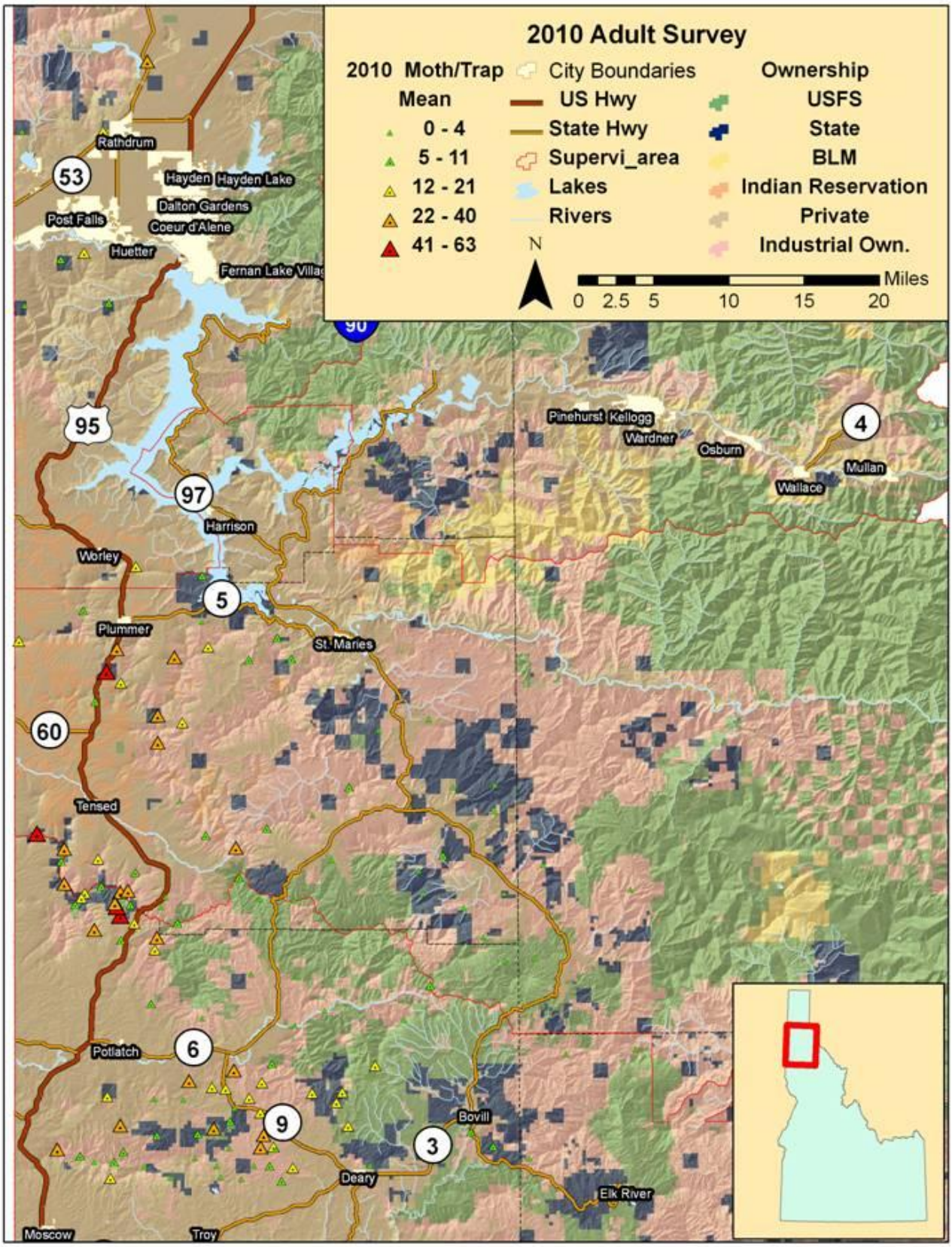

Figure 1. Map of plots trapped by IDL for Douglas-fir tussock moth in 2010.

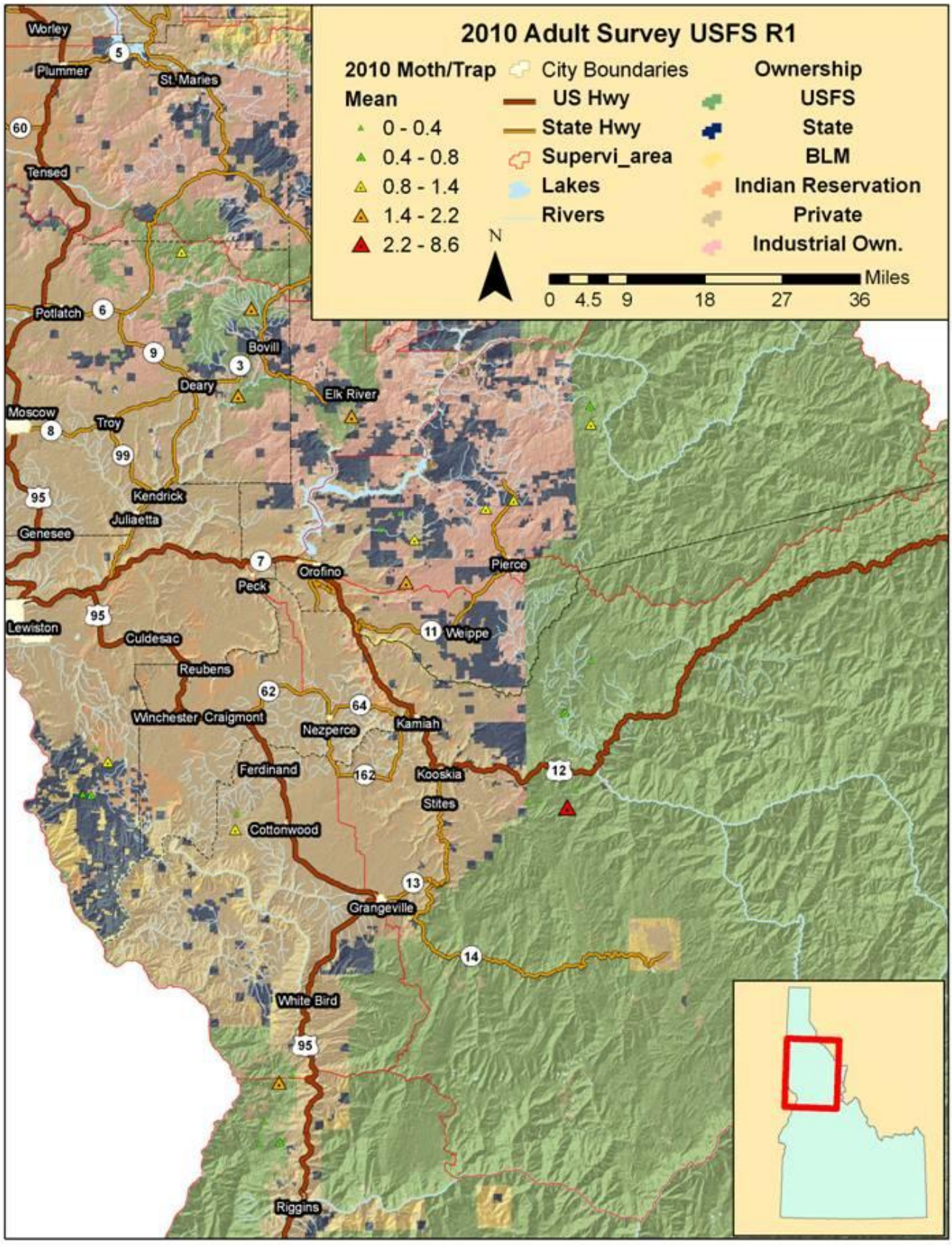

Figure 2. Map of plots trapped by USFS Region 1 for Douglas-fir tussock moth in 2010.

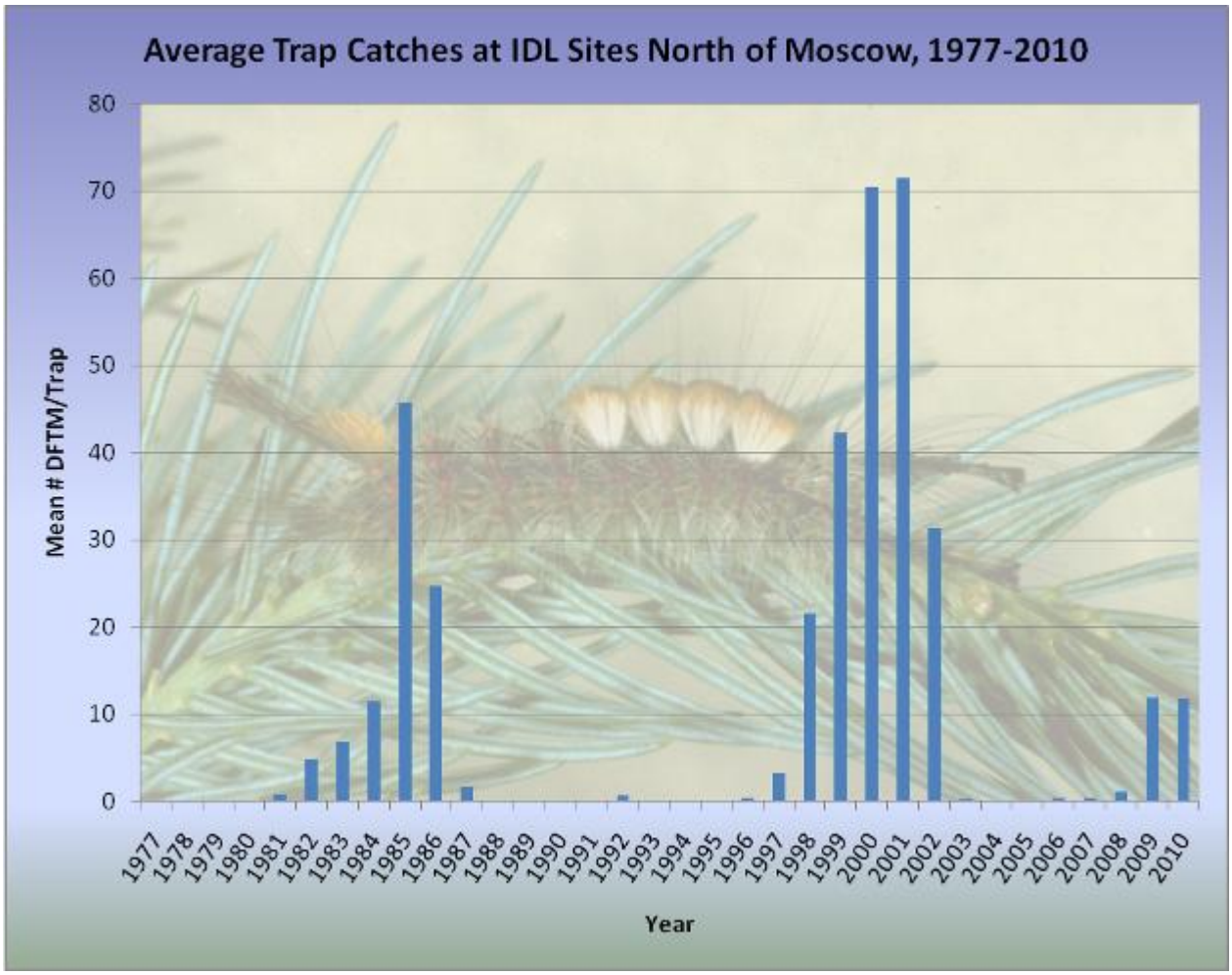

Figure 3. Mean trap catches of Douglas-fir tussock moth by IDL for plots north of Moscow from 1977 through 2010.

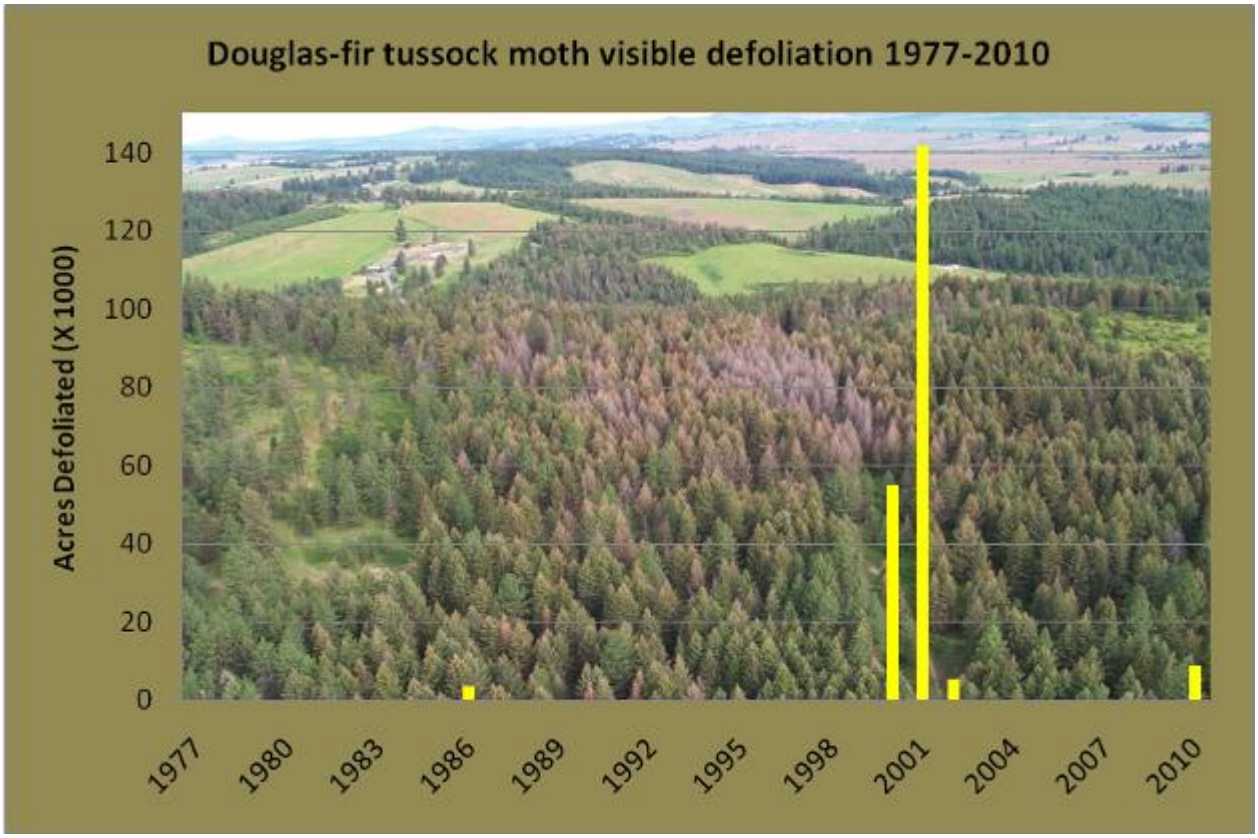

Figure 4. Aerially detected defoliation in northern Idaho since 1977.

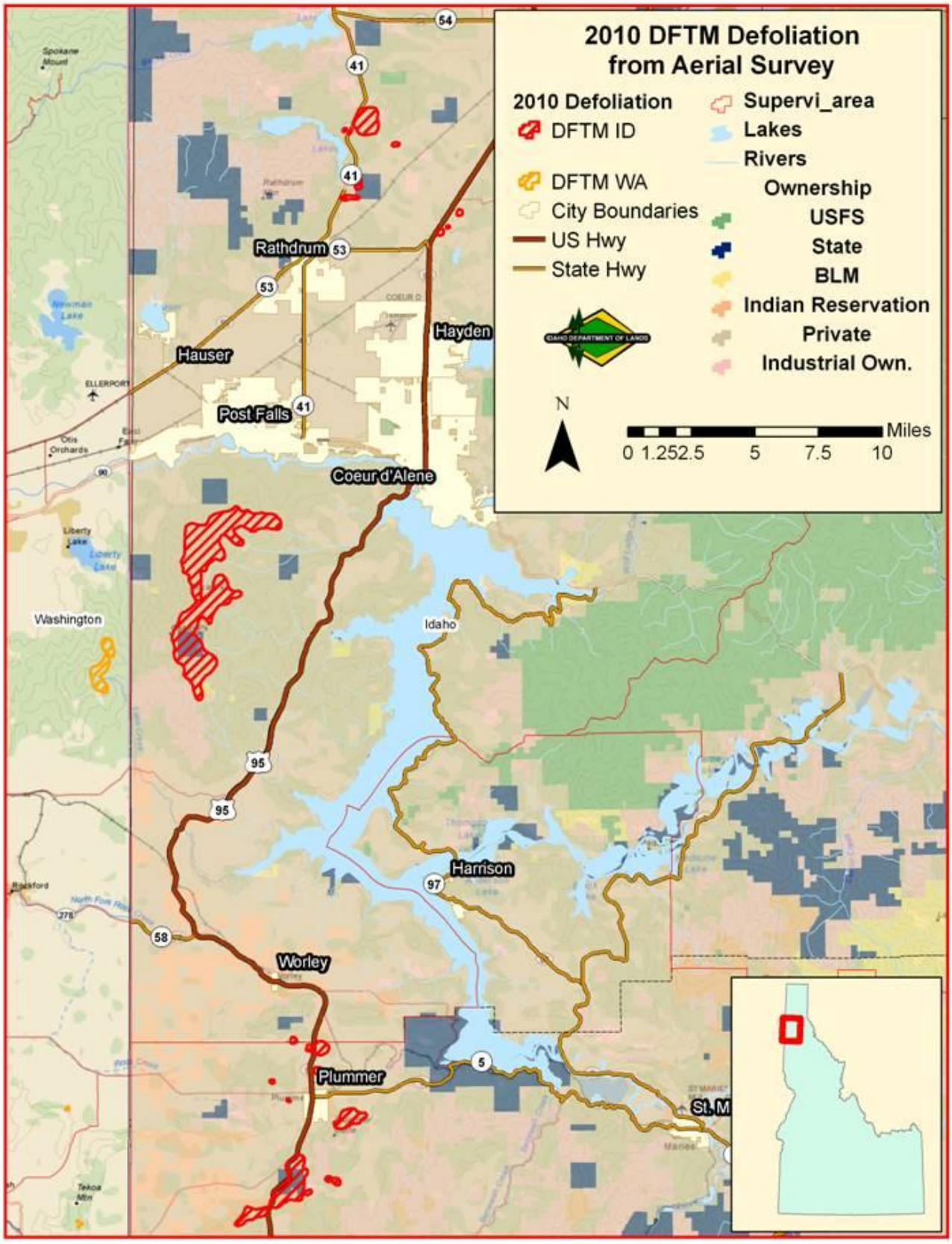

Figure 5. Douglas-fir tussock moth defoliation visible via aerial survey in north Idaho in 2010.

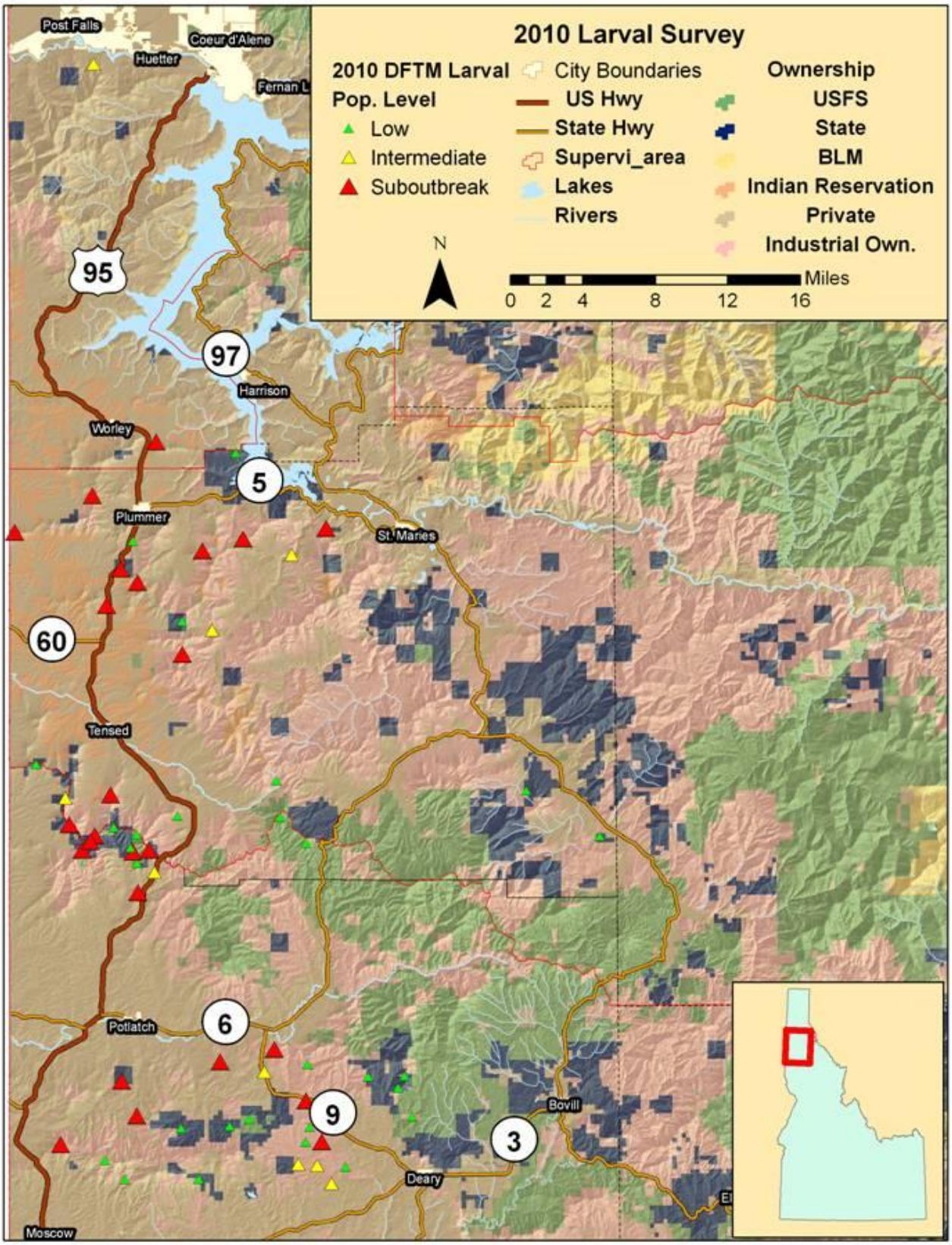

Figure 6. Sites sampled for Douglas-fir tussock moth larvae by IDL in 2010.

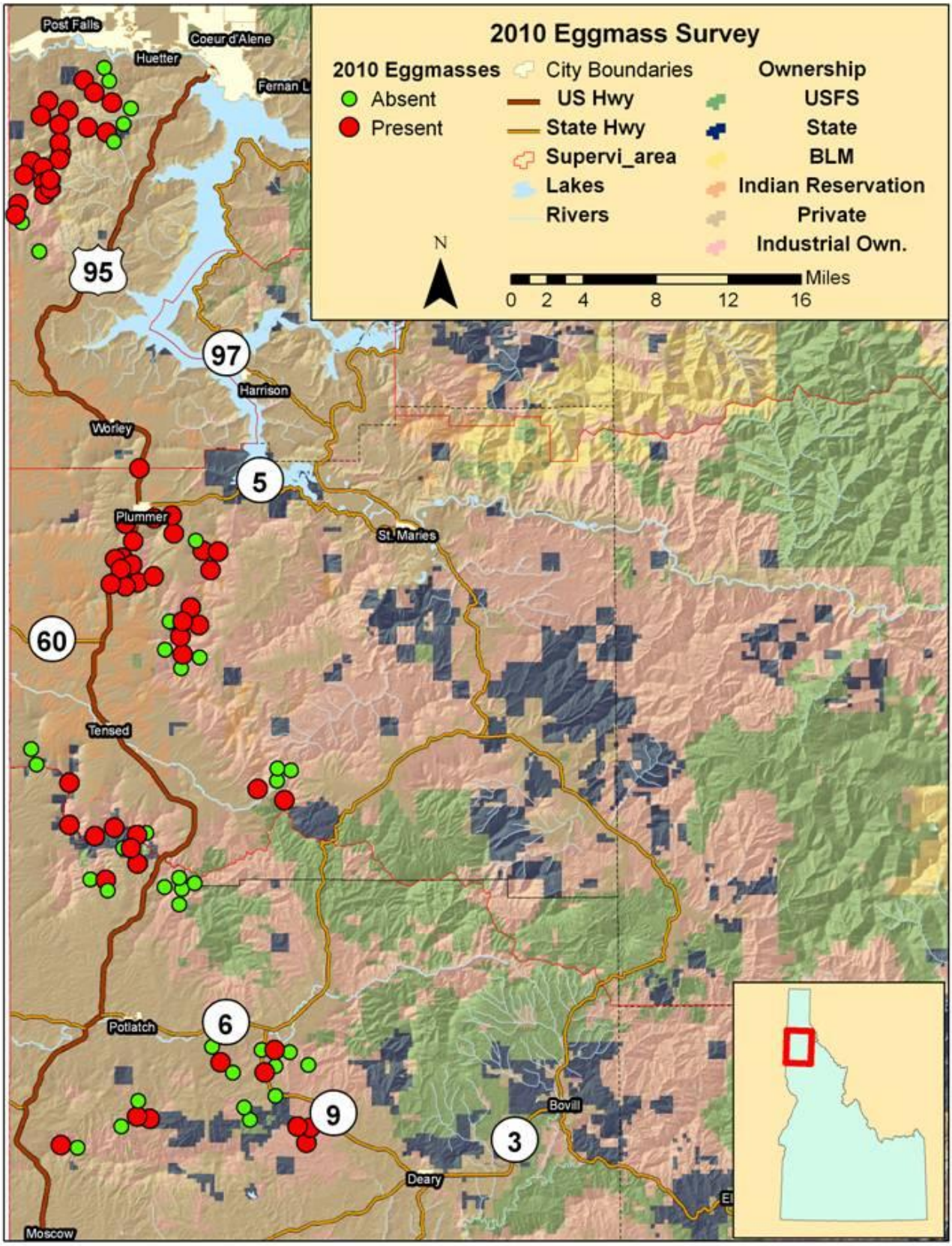

Figure 7. Sites sampled for Douglas-fir tussock moth egg masses by IDL in 2010.

Appendix 1. Mean trap catch for IDL monitored plots from Coeur d'Alene to Moscow for the past 10 years.

IDL 2001 - 2010 Douglas-fir Tussock Moth Trap Results

		Mean Number of Moths Per Trap									
Plot #	Area	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
3	Lolo Pass	*26.4*‡	5.2	0.4	0‡	0	0	0	0	8.2	110.2
4	Charles Butte	*32.2*‡	5.4	0	0‡	0	0	0	0.2	28.2	84.8
5	Peterson Point	8.6	2.2	0	0‡	*	0	0	0.2	15.8	101.0
6	East Dennis	2.3‡	9.0	0.2	0.2‡	0	0	0	1.2	75	101.2
7	East Gold Hill	2.0	3.4‡	0.8	0‡	0	0	0	0.2	14.8	53.8
8	Flat Creek	8.0	1.0	0.2	0‡	0.4	0	0.2	0	7.6	88.0
9	Long Creek	10.2‡	*20.6*‡	3.4‡	3‡	0.2	0	0.2	0.2	33.6	0.2
10	Paradise Point	9.8	2.0‡	1.2	0.2‡	0.2	0	0.2	0	17	91.8
11	Mineral Mountain	10.8‡	*25.0*‡	4.2‡	0.5‡	0	0	0	1.8	75.2	56.4
12	Mission Mountain	8.0‡	*20.8*	0.6	0.2‡	1.2	0	1.2	0.2	25.6	1.6
13	Spring Valley Creek	1.0	0.6	0	0‡	*	0	0	0	5.4	58.0
14	Vassar Meadows	17.0‡	12.8	0‡	0.4‡	0	0	0	0	95.8	102.8
15	Fairview Knob	6.6‡	9.2‡	0.8‡	0.4‡	0	0	0	0.2	39	105.8
21	West Twin (10-115)	4.0‡	5.3‡	1.2‡	0.4	*	0	0	0	8.8	75.4
22	Moscow Mtn (115-114)	0.0	3.6	0	0	0	0	0	0.2	5.8	78.0
101	Benewah	16.4‡	5.0	0	0.2‡	1.4	0	1.4	2.8	52.2	92.4
102	Windfall Pass	*29.4*‡	*32.0*‡	12.5‡	0.75‡	0.6	0	0.6	0.6	40.4	99.6
103	Squaw Creek	2.6	1.8	0	0	*	0	0	0.2	9.4	89.2
104	Moses Mountain	7.5	3.4	0.2	0	0	0	0	0.2	6.4	67.8
105	Little John Creek	0.0	2.2	0‡	0.6	0	0	0	1.4	45	78.4
106	Emida Peak	1.4	1.6	0‡	0.4	0	0	0.2	2.6	64.2	75.8
107	North-South Ski Area	2.3	m	0	0	0	0	0	0.6	83.2	107.2
108	Bald Mountain	*	*	*	*	*	0	0	0	25.2	53.8
109	Laird Park	1.4	2.2	m	0	0	0	0	1	66	86.0
110	North Fork Palouse River	0.0	0.4	0	0	0	0	0	1	83.2	75.2
111	Mica Mountain	16.6‡	20.8	0.2	0.2	0	0	0	0.2	67.6	93.6
112	Schwartz Creek	16.2‡	7.0	0.4	0	0	0	0	0.2	80.6	110.6
113	Big Bear Creek	15.2‡	11.6‡	1.8‡	0.6‡	0.6	0	0.6	0.2	47.8	87.0
114	Big Meadow Creek	0.8‡	0.4	0	0‡	0.2	0	0.2	0	11.2	70.2
115	East Twin Mountain	6.8	5.4‡	1.2‡	0.4‡	0.2	0	0.2	0	7.6	85.4
116	Crane Point	6.8	0	0.2	0	*	0	0	0	51	89.0
117	Sheep Creek	*21.0*‡	*20.8*‡	2.0	0‡	0.2	0	0.2	0	27.8	83.2
118	West Fork Mission Creek	7.0‡	6.8‡	1.4	0.2	*	0	0	0	22.2	47.6
119	1 Mi N. of Mineral Mtn (11-216)	*24.6*	2.2	0.2	0	*	0	0	0	25.2	0.2
200	2 mi W of Plummer	7.0‡	*34.2*‡	2.2‡	2.6	*	0	0	0	16.2	80.2
201	Coon Creek	18.0‡	21.8‡	1.8‡	3‡	2	0	0.4	0.2	21.6	93.8
202	3 mi E of Benewah	*	*	*	*‡	0.2	0	0.2	0.6	21	102.2
203	Benewah Point	8.4	3.4	0‡	0.4	*	0	0	0	8.2	92.4
204	John's Point	*	*	*	*	*	0	0	0	23.8	*
205	3 mi E of Charles Butte	6.5	2.0	0‡	0.8‡	0	0.2	0.2	0.4	63.6	72.6
206	Sunset Mountain	*	*	*	*	*	0	0	0	20.8	*
207	West Fork Emerald Creek	0.0	0.4	0.2	0	*	0	0	0	23.2	*
208	Cedar Butte	1.4	0.4	0	0	*	0	0	0	22.4	76.2
209	Abes Knob	5.6	2.4	0.2	0.2	*	0	0	0	23.8	88.4
210	West Fork Deep Creek	*29.6*	4.6	0	0.2‡	0.2	0	0.2	0.2	77	90.6
211	Cherry Butte	2.8	0.6	0	0‡	0	0	0.2	0.4	67.2	88.6
212	Jackson Mountain	1.6	1.0‡	1.0	0.2	*	0	0	0	19.6	*

Appendix 1. (continued)

IDL 2001 - 2010 Douglas-fir Tussock Moth Trap Results

		Mean Number of Moths Per Trap									
Plot #	Area	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
216	1 mi NW of Mineral Mtn	*27.6*‡	*32.4*‡	0.8	0‡	0.4	0	0.4	0.2	1	0.2
217	Head of Sheep Creek (216-117-2)	*8.8*‡	*36.8*‡	7.8	0‡	0.2	0	0.2	0.6	21.2	97.2
300	Mission Mountain (#2)	13.8‡	*22.4*‡	2.2	0	0.4	0	0.4	0.6	6.4	67.0
301	1.5 mi S of Mineral Mtn	*62.8*‡	37.6‡	2.4	0‡	0.2	0	0.2	0.2	69.4	91.2
302	Middle Fork of Deep Creek 1	48.6‡	*38.0*‡	3.6‡	1	*	0	0	0	63.8	3.6
303	Middle Fork of Deep Creek 2	*27.2*‡	*33.0*‡	1.6	0.2	0.4	0	0.2	1	58	15.8
400	3 mi S of Mineral Mtn	*23.8*	1.0	0‡	0.6‡	0.2	0	0.2	0.6	75.8	86.6
401	Flynn Butte	3.4	0.6	0	0	0	0	0	3.2	95.2	96.4
402	2 mi SE of Browns Mdw	3.0	4.8	0	0.2‡	0.2	0	0.2	0	15.2	57.4
500	3 mi SW of Harvard	13.4	1.0	0	0‡	0.2	0	0.2	0	18.8	74.6
501	3 mi S of Moon Hill	*1.4*	1.0	0	0	*	0	0	0	16.2	97.6
502	3 mi W of Crane Point	15.2‡	6.2	0	0.2	*	0	0	0.6	67.6	75.0
503	3 mi N of Stanford Point	17.5‡	17.6‡	1.0‡	1	*	0	0	0	10.2	89.4
504	2 mi N of Stanford Point	12.2‡	10.2	0.0	0‡	0.4	0	0.4	0.2	47.8	86.2
505	1 mi SW of Stanford Point	4.5‡	9.2‡	1.6	0.2‡	*	0	0	0	38.4	47.0
506	1 mi S of Stanford Point	5.8‡	*44.4*‡	4.0‡	1	*	0	0	0	23.4	67.8
507	1 mi NE of Stanford Point	1.6	2.0	0.8	0	0	0	0	0.8	40.6	87.4
508	1 mi W of Stanford Point	*23.4*‡	*27.0*	0‡	0.4	0.2	0	0.2	0	20.6	92.4
509	2 mi NW of Stanford Point	13.8‡	*26.6*‡	0.8‡	1.2‡	0.6	0.2	0.4	0.4	43.2	81.6
510	Moon Hill	*36.0*‡	18.2‡	1.2	0‡	0.2	0	0.2	0.8	35	67.2
511	2 mi SE of Moon Hill	*20.4*‡	*21.0*‡	2.4	0	*	0	0	0.2	13.2	80.4
512	3 mi S of Mineral Mtn	5.6‡	9.4	0	0	*	0	0	0.2	70.2	*
513	2 mi SW of Moon Hill	13.0	1.2	0‡	1.4	*	0	0	0	9.6	9.2
514	1.5 mi NW of Avon	6.2	3.0	0	0	*	0	0	0	6.8	61.4
600	3.4 mi NNW of Princeton	4.8	4.0	2	0.25‡	*	*	*	*	*	*
601	Macumber Meadows	1.6	0.6	0	0‡	*	*	*	*	*	*
602	S of Shay Hill	0.2	4.4‡	1.2	0.2	*	*	*	*	*	*
603	3 mi. S of Chatcolet	10.8‡	*29.2*‡	3.6	0	*	*	*	*	*	*
701	Fourmile Creek	*28.2*‡	12.2‡	2.2‡	0.4	*	0	0	0	9	88.6
702	North of Granite Point	10.2	3.4	0.6	0	*	0	0.2	0	5.8	76
703	Bergs Creek	3.2	2.4	0	0	*	0	0	0	12.2	96.6
704	West Fork Big Bear Creek	8.8‡	9.4‡	0.8	0‡	0.2	0	0.2	0.2	13.2	61
705	2 Mi NW of Stanford PT	*34.2*‡	*43.0*‡	3.0‡	1.5‡	0.8	0	0.8	0.4	46.4	89.4
706	1 Mi S. of Iron Mtn	*27.8*	2.0	0.2‡	0.8‡	*	0	0	0	27.2	87.8
707	Iron Mtn	*	*	*	*	*	0	0	0	6.6	97
708	Little Bear Creek	12.4‡	7.3	0‡	0.4‡	*	0	0	0	65.6	108.6
709	Ruby Creek	10.6	2.4‡	4.0	0	*	0	0	0	50.4	96.2
710	Turnbow Creek	*33.0*‡	15.8	0‡	2.4‡	1.4	0	1.4	0.2	43	70.6
711	East Fork Flat Creek	*20.8*‡	17.6	0‡	2‡	2.6	0	2.6	0.2	55	71.4
712	Turnbow Point	1.2	0.2	0.4	0.2	*	0	0	0.2	7.8	38
713	3 Mi S. of Potlatch	13.0‡	8.8‡	5.8	0‡	*	0	0	0	6.6	30
714	Rocky Point	*25.6*‡	*46.6*	0.0‡	0.8	*	0	0	0	13.2	79.6
715	Hatter Creek	0.0	0.2	0	0‡	0.6	0	0.6	0.2	7.4	32
716	Head of Hatter Creek	0.4	0	0	0	*	0	0	0	11.8	80.8
717	Nora Creek	0.2	0.2‡	1.4	0	*	0	0	0	21.2	81.4
718	Crummaring Creek	13.6‡	6.4	0.4	0.2	*	0	0	0	12.4	70.4
719	Basalt Hill	10.4‡	7.3	1.2	0.2	*	0	0	0	19	11.6
720	Browns Meadow	*30.0*‡	18.2	0‡	0.4	0	0	0	0.2	11.2	2.6
721	Smith Creek	2.6	0	0.4	0	*	0	0	0	100.2	70.6

Appendix 1. (continued)

IDL 2001 - 2010 Douglas-fir Tussock Moth Trap Results

		Mean Number of Moths Per Trap									
Plot #	Area	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
722	Prospect Peak	*14.4*	2.8	0.4	0	*	0	0	0	31.2	56.8
723	West Fork Mission Creek	15.8‡	*38.4*	0	0	*	0	0	0	27.8	22.2
724	Huckleberry Mtn	*30.2*‡	14.8	0.2	0‡	*	0	0	0	16.6	77.2
725	North Fork Pine Creek	*43.6*‡	13.6‡	1.2‡	0.75	*	0	0	0	21.6	93
726	Mineral Creek	5.4‡	10.4	0	0	*	0	0	0	20.2	78
727	South of Sanders	3.6	0.8	0	0	*	0	0	0	77.8	86.8
800	Mason Butte	13.2‡	*38.2*‡	9.0‡	7.25	*	*	*	0	20.8	63
801	1 mi SW of Moctileme Butte	6.8‡	9.8‡	2.8	0.2	*	*	*	0	30.2	91.4
802	1.9 mi S of Plummer	*40.0*‡	*39.6*‡	1.6	0	*	*	*	0	24.8	75.2
803	Little Plummer Creek	*14.2*‡	*57.0*‡	17.6‡	5.8	*	*	*	0	18	54.4
804	Syringa Creek	1.3	0.4	0	0	*	*	*	0	21.2	66.4
805	John Point	*	*	*	*	*	*	*	0	20.4	61.6
806	2 mi W of Pettis Point	3.6	0.4	0.2	0	*	*	*	0	22.6	71.2
807	Davis Creek	3.0	m‡	1.0	0	*	*	*	0	17.8	55.6
808	Renfro Creek	3.0	0.4	0	0	*	*	*	0	14.8	44.2
809	Crystal Creek	0.6	0.4	0	0.2	*	*	*	0	10.4	29.4
810	Child Creek	0.6	0.6	0.2	0	*	*	*	0	17.2	52.8
811	Hobo Pass	2.5	m‡	2.4‡	0.6	*	*	*	0	7.8	25.4
812	Hemlock Butte	1.8	0.5	0.2‡	0.4	*	*	*	0	9.2	28.2
813	Carpenter Peak	3.6	1.6	0	0	*	*	*	0	18.8	57.8
814	Tyson Creek	1.0	2.8	0	0	*	*	*	0	30.2	87.6
815	Heinaman Creek	0.6	m	0.6	0	*	*	*	0	25.2	85.2
816	Green Mtn	4.8‡	5.2	0.4	0	*	*	*	0	31	86.2
817	Willow Creek	1.4‡	6.2‡	2.6‡	1.2	*	*	*	0	22.2	73.2
818	Head of Emerald Creek	5.8	3.6	0	0.6	*	*	*	0	28.2	86
819	East Fork Emerald Creek	1.0	0.2	0	0	*	*	*	0	25	75.2
820	Head of Bobs Creek	2.0	0.6	0	0	*	*	*	0	25.4	79
821	East Fork of Potlatch River	5.0	3.8	0.2	0	*	*	*	0	25.2	67.2
822	Head of Moose Creek	14.8	2.2	0	0.2	*	*	*	0	24.8	69.6
823	Beals Butte	1.2	2.2	0	0	*	*	*	0	39	106.2
900	Hauser	1.8	2.4‡	1.4	*	*	*	*	*	*	*
901	Cougar Bay	*6.4*‡	5.2‡	1.4	*	*	*	*	*	*	*
902	Marie Creek	2.0	1.2‡	0.8	*	*	*	*	*	*	*
903	Canary Creek	3.8	2.8	0	*	*	*	*	*	*	*
904	Rathdrum	17.2	2.6	*	*	*	*	*	*	*	*
905	State Line (Post Falls)	0.6	2.0	*	*	*	*	*	*	*	*
906	Signal Point (Post Falls)	9.4‡	41.8	*	*	*	*	*	*	*	*
907	Blake Draw Creek	6.6‡	7.0	*	*	*	*	*	*	*	*
908	Coon Creek	*33.2*‡	*71.6*	*	*	*	*	*	*	*	*
909	Heyburn Park	11.4‡	9.6	*	*	*	*	*	*	*	*
910	Coyote Lane Post Falls	18.6‡	*67.6*	*	*	*	*	*	*	*	*
911	State Line (Meredith Rd)	14.4‡	23.2	*	*	*	*	*	*	*	*
912	Lovell Valley Direct Sale	*55.2*‡	*69.6*	*	*	*	*	*	*	*	*
913	Twin Lakes	*35.6*	*	*	*	*	*	*	*	*	*
	Number of Sites Trapped:	134	133	124	120	51	98	98	122	122	117
	Average Number of Moths per Plot:	**11.77**	**11.86**	**1.12**	**0.42**	**0.33**	**0.00**	**0.16**	**0.23**	**31.3**	**71.5**

* Indicates Sites Not Trapped
Italics indicates egg mass sample
m indicates traps missing
‡ Indicates larval survey

Appendix 2. Mean trap catch for USFS monitored plots from Potlatch to Lucille for the past 10 years.

USFS R1 2001 - 2010 Douglas-fir Tussock Moth Trap Results

		Mean Number of Moths per Trap									
Plot #	Site Name	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
1-1	Lodge Pt	0.2	3.0	0.0‡	0.0	0.0	0.0	0.0	0.2	1.2	1.6
1-2	Goddard	*	*	*	*	*	*	*	*	*	*
1-3	Pine Knob	8.6	16.4	0.0‡	0.2	0.3	0.0	0.0	0.0	1.0	4.8
1-4	Potatoe Hill	0.4	1.4	0.0‡	0.0	0.0	0.0	0.0	0.0	0.2	0.2
1-5	Big Tinker	0.2	0.0	0.0‡	0.0	0.2	0.0	0.0	0.0	0.6	1.4
2-1	Rhett Cr	0.0	0.0	0.33§	0.0	0.0	0.0	0.0	0.0	0.0	0.4
2-2	Christie Cr	1.6	1.4	0.67§	0.0	0.0	0.0	0.0	0.0	0.0	8.0
2-3	Cow Cr Saddle	*	*	*	*	*	0.0	0.0	0.0	0.2	0.2
2-4	Low Saddle	*	*	*	0.0	0.4	0.0	0.0	0.0	0.0	0.4
2-5	S. Cow Cr	0.8	1.4	0.0§	0.0	0.0	0.0	0.0	0.0	0.0	1.8
2-6	Spring Mtns	0.0	1.4	0.0§	0.0	0.0	*	*	*	*	*
2-7	New Site	0.4	*	*	*	*	*	*	*	*	*
3-1	Keuterville	1.2	0.4	0.0§	0.0	0.0	0.0	0.0	0.0	0.0	2.2
3-2	Cottonwood Butte	0.2	0.4	0.0‡	0.0	0.0	0.0	0.0	0.0	0.0	2.8
4-1	Lake Waha	0.0	0.0	0.0§	0.0	0.0	0.0	0.2	0.0	0.0	10.2
4-2	Black Pine	0.6	4.0	1.25‡	0.2	0.0	0.0	0.0	*	0.2	18.2
4-3	Junction	0.8	0.8	0.0§	0.0	0.0	0.0	0.0	0.0	0.0	*
4-4	Captain John	0.0	1.0	0.33§	0.0	0.0	0.0	0.0	0.0	0.2	3.6
4-5	Webb Cr	*	*	*	0.0	0.0	0.0	0.0	0.0	0.0	1.4
4-6	Forest	*	*	*	*	*	*	*	*	*	*
4-7	New Site	1.2	9.4	0.0§	*	*	*	*	*	*	*
5-1	Johnson	*	*	*	*	0.0	0.0	0.0	0.0	4.8	4.0
5-2	Angel Butte	0.2	0.6	0.0	*	0.0	0.0	0.0	0.4	0.8	5.8
5-3	Grangemont	1.2	1.0	0.80	1.4	1.4	0.0	0.0	0.4	2.2	16.2
5-4	Bargamin Cr	m	2.0	0.60	4.6	0.0	0.0	0.0	0.0	4.8	35.6
5-5	Bald Mtn	1.2	1.6	0.20	3.4	1.8	0.0	0.0	0.2	9.0	36.0
5-6	Summit Landing	1.2	1.8	1.00	3.2	0.6	0.0	0.0	0.2	0.0	14.6
5-7	Shin Pt	1.0	0.2	0.25	0.0	0.0	0.0	0.0	0.0	1.3	13.2
5-8	Swanson Cr	0.8	0.8	0.40	0.8	0.6	0.0	0.0	1.4	0.0	17.5
5-9	Skull Cr	*	*	*	*	*	*	*	*	*	*
5-10	Cooper	*	*	*	0.0	0.0	0.0	0.0	0.0	0.2	3.8
5-11	New Site (2009)	2.0	3.6	*	*	*	*	*	*	*	*
5-12	New Site (2009)	0.0	1.0	*	*	*	*	*	*	*	*
6-1	Canyon Junction	0.4	1.2	0.25‡	0.4	0.0	0.0	0.0	0.0	0.8	11.2
6-2	Fan saddle	*	*	*	0.0	0.0	0.0	0.0	0.0	0.2	0.6
6-3	New Site	0.8	0.0	0.0	*	*	*	*	*	*	*
7-1	Laird Park	*	*	0.0	0.2	0.0	0.0	0.0	0.0	52.2	*
7-2	Little Bald Mtn.	1.4	3.6	*	0.0	0.0	0.0	0.0	0.2	22.0	*
7-3	Little Boulder Cr.	2.2	1.0	0.20	0.0	1.2	0.0	0.0	4.0	40.4	*
7-4	W. Fork Potlatch R.	2.0	1.2	0.80	0.0	0.8	0.6	0.0	2.4	40.4	*
7-5	Elk Creek Falls	1.8	2.0	0.80	0.2	0.4	0.4	0.0	4.8	15.8	*
7-6	Morris Creek	m	1.4	0.75	0.0	0.2	0.0	0.0	0.2	26.5	*
	Number of Sites Trapped:	32	31	29	31	33	33	33	32	33	26
	Mean Number of Moths per Site:	1.08	2.06	0.30	0.47	0.24	0.03	0.01	0.45	6.82	8.30

* Indicates Sites Not Trapped
‡ Indicates 4 traps/site in 2008
§ Indicates 3 traps/site in 2008
m indicates missing traps

Appendix 3. Mean trap catch for USFS monitored plots in southern Idaho for the last three years.

USFS R4 2008 Douglas-fir Tussock Moth Trap Results

	Site	2010	2009	2008
1	South Fork Boulder Creek	0	0.2	0.2
2	Mill Creek	0.2	0.2	0.2
3	New York Summit	0	1.6	1.2
4	Baldy Mt.	0.2	0.8	1
5	Upper Wolftone Creek	0	0.8	1.4
6	Brundage Mt Resort	0.2	1.6	1
7	Bogus Basin Resort	0.2	15.2	15.4
	Number of Sites Trapped:	7	7	7
	Mean Number of Moths per Site:	0.16	2.91	2.91